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OBSERVATIONS ON THE REPRODUCTIVE SYSTEM OF THE FEMALE OF *MYOBATRACHUS GOULDII* (GRAY)

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I. INTRODUCTION

Myobatrachus gouldii (Gray), one of the most specialised and atypical of the Australian Amphibia, is restricted to Western Australia and is known only from the area between Geraldton and the Abrolhos Islands in the north and the Stirling Ranges, Truslove and Esperance in the south-east (Fletcher, 1898; Glauert, 1945). The species is largely subterranean in habit and most of the specimens in collections have been taken through chance excavation or found under logs and stones. However, Philipp (1958) suggested that the frogs might move about on the surface on rainy nights and one of us (L.M.S.) observed a small individual walking in the open on a wet winter evening eight or nine years ago. Apart from the occurrence of the frogs in the field, the only aspect of the biology that is at all well known is the feeding behaviour. Calaby (1956) showed from extensive gut-content analyses that the food consisted almost entirely of termites and Philipp (1958) gave an account of *Myobatrachus* feeding on termites in captivity.

Very little is known of the reproductive biology of the species. From its distribution and behaviour, it appears to be independent of free water for reproduction. Harrison (1927) gave some indirect evidence for this, having found that in a specimen taken at Eradu "the ovarian follicles were well developed, measuring upwards of 3 mm. in diameter." Further, Glauert (1945) noted that "the eggs are very large and probably develop away from water." Main *et al* (1959) have also suggested that the larval development lacks an aquatic stage.

II. ANATOMY OF THE FEMALE REPRODUCTIVE TRACT

On September 14, 1958, one of us (LM.S.) obtained a *Myobatrachus* of length 47 mm. which had been excavated from a depth of about 1 foot in yellow sand at Mt. Pleasant. The frog appeared to be a gravid female and in an attempt to induce ovulation, a suspension of fresh pituitary glands from four female toads, *Bufo*

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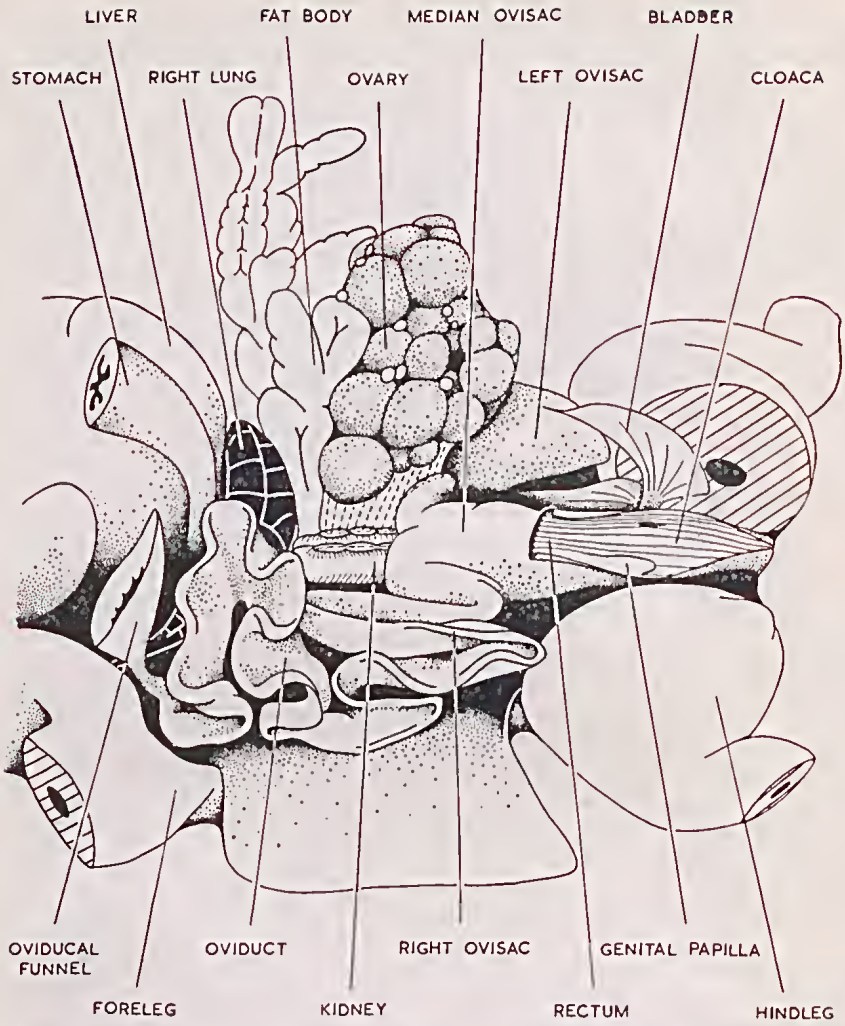

Fig. 1.—The reproductive system of a female of *Myobatrachus gouldii* (Gray). Accession no. R.13068. The right lobe of the liver and the right ovary have been removed. The oviducal funnel is drawn diagrammatically.

marinus (Linnaeus), was introduced into the dorsal lymph sac. The glands had no obvious effect on the reproductive system and the frog died on September 24, nine days after the injection.

Subsequent dissection showed that the genital system presented unusual features which help in the interpretation of the reproductive processes of the frog (fig. 1).

A. The eggs were few in number but were large and yolky. After fixation in 10% formalin for 24 hours, the largest ovum had a diameter of 5.1 mm. (measured with vernier calipers) and there were 48 ova with diameters greater than 2.5 mm. In addition, the

ovaries contained approximately 50 small eggs, most of which measured 1 mm. or less (fig. 3).

B. The oviducts were broad and convoluted, opening anteriorly into a dilated funnel lying between the large liver and the heart. At the posterior end each oviduct was expanded into a folded lateral ovisac.

C. The lower ends of the lateral ovisacs narrowed and then joined into a median ovisac. This strikingly uterus-like structure discharged through a genital papilla on the dorsal wall of the cloaca. The inner wall of the median ovisac was strongly folded, probably to permit expansion after ovulation when the lower part of the tract becomes distended with eggs (see IIIC. below).

III. DEVELOPMENT OF THE REPRODUCTIVE SYSTEM

To obtain additional data on the reproductive cycle, the 42 opened *Myobatrachus* in the collections of the Western Australian Museum were examined. Of these, 29 proved to be females, ranging in length from 24-53 mm. and 13 were males, with lengths from 27-49 mm. The diameters of the ova in females of the series were measured with calipers to the nearest 0.5 mm. but preservation had caused some of the eggs to become compressed and in these cases the maximum dimension was taken. Ova smaller than 2.5 mm. were difficult to measure accurately and were not included in the calculated mean diameters of developing eggs.

A. The immature reproductive tract.

In immature females (i.e. females with undeveloped ovaries) the eggs were of approximately uniform size, 1 mm. or less in diameter. The lateral oviducts were uncoiled and threadlike, closely parallel to the outer border of the kidney, and the median ovisac was clearly distinguished but short and narrow.

B. Size and maturity.

The smallest *Myobatrachus* with developing ova measured 30 mm. from snout to cloaca. In this specimen only 6 ova had a diameter exceeding 2 mm. and the remainder were extremely small. In two 33 mm. frogs the ovaries contained 1 and 4 ova greater than 2 mm. but in the second of these frogs the ovaries had been damaged in the previous gut-content examination. In one specimen of length 34 mm. the left ovary was well developed and the right ovary was rudimentary. The smallest *Myobatrachus* with well developed ovaries measured 37 mm.

On the other hand, undeveloped ovaries were found in frogs with lengths ranging from 24 to 42 mm. These specimens had been received at the Museum at different times of the year.

C. Enlargement of the ova and ovulation.

A graph of the mean diameter of developing ova from each frog, plotted against the date of accession, showed a yearly growth trend (fig. 2). Two factors complicate the interpretation of the trend:—

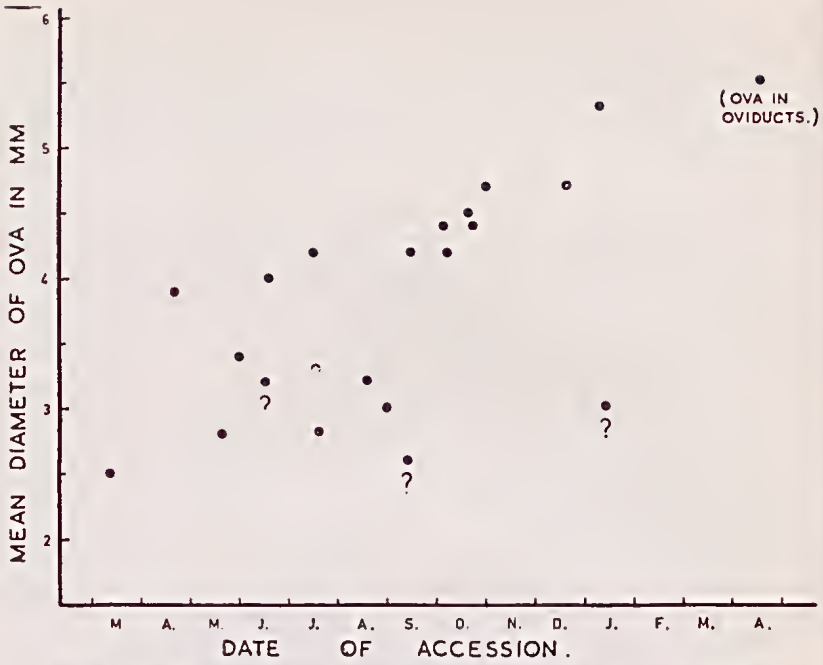

Fig. 2.—The growth of ova in *Myobatrachus gouldii* (Gray)

i. The date of accession as recorded, in the Museum registers, may not necessarily approximate to the date of collection.

ii. Climatic conditions differ between years of collection and also between localities. However, no correlation could be observed between the variability of egg sizes in the March-August period and the seasonal distribution or total amount of rain.

The points marked with a query represent measurements of less than 6 ova and all were taken from frogs apparently in their first year of reproduction (see IIIB above). Their value is questionable.

Only one specimen (R2590, accessed April 17, 1929) had eggs in the oviducts. These ova were the largest measured, ranging up to 7 mm. with a mean of 5.5 mm. and were taken to represent the end point of the yearly growth trend. None of the eggs showed any external sign of cleavage. Because of the distension of the lateral and median ovisacs and some prior damage, the limits of the reproductive tract were not clearly visible. However, there was no appearance of glandular thickening, the walls of the ovisacs being thin and transparent.

The possession of a median ovisac is not a feature peculiar to *Myobatrachus*. Bhaduri (1953) reported 17 genera, including representatives of almost every family of Salientia, as possessing a common "uterus" or ovisac. Despite the similarity in structure of the "uteri" of *Myobatrachus* and the ovoviviparous South African frog *Nectophrynoides* (Noble, 1931), the absence of ovoviviparity in any

other of the 17 genera precludes an inference as to the status of *Myobatrachus* with regard to embryonic and larval development.

Measurements of eggs from frogs late in the reproductive cycle showed two size-frequency peaks, one representing the large developing eggs for the approaching autumn and the other, small eggs for subsequent autumns (fig. 3). Eggs smaller than 2.5 mm. were difficult to count, particularly those of R2590, in which they were attached to the ruptured walls of the ovary. The black columns for these sizes therefore represent minimum numbers. The two histograms illustrate clearly the difference in development of the ova at different times in the yearly cycle.

IV. CONCLUSIONS

A. Large yolky eggs are found commonly in Amphibia which develop away from water, metamorphosis proceeding either in a pool of jelly formed by the breakdown of the egg capsules, or within the egg itself. It may therefore be supposed that development in *Myobatrachus* is intracapsular but there is insufficient evidence to indicate whether the frog is oviparous or ovoviviparous.

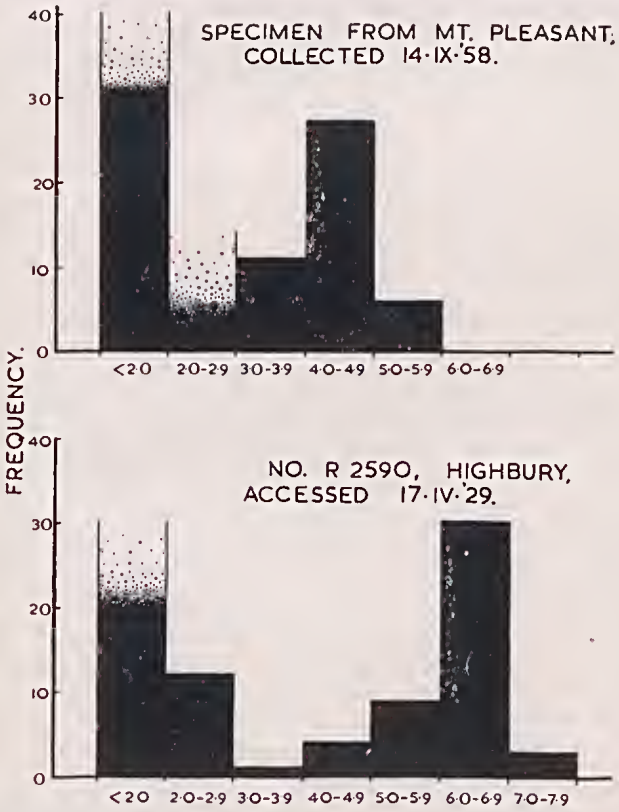

Fig. 3.—Size-frequency histograms of the ova of *Myobatrachus gouldii* (Gray). Horizontal scale shows the size-classes of ova diameters in millimetres.

B. Observations are consistent with the hypothesis that ovulation occurs in the late summer to early autumn, and that residual small follicles in the ovary enlarge during the succeeding 12 months, reaching a mature diameter of 5-7 mm. in the middle of the following summer.

C. Philipp (1958) collected 15 mm. *Myobatrachus* in August and suggested that these froglets hatched from eggs fertilised 3-4 months previously. The yearly growth cycle data presented here support this suggestion. As ovarian enlargement may be commenced at a body length of between 30 and 40 mm. a period of at least two years probably intervenes between hatching and the first ovulation.

V. ACKNOWLEDGMENTS

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CATASTROPHIC DESTRUCTION OF THE LITTORAL FAUNA AND FLORA NEAR FREMANTLE JANUARY 1959

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INTRODUCTION

In late January 1959 there were exceptionally low tides on the coast near Fremantle. The Harbour Trust gauge was out of order during this period, but visual observations there were within $\pm$ 0.05 ft. of those recorded at Rottnest (table 1). Mean low water for